THE ROLE OF MELTDOWN EVALUATION IN SENSORY QUALITY CONTROL

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IDFA
Ice Cream Technology Conference

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BACKGROUND

- Ice cream is changing
  - Product parameters being shaped by consumer-generated constraints
    - "Natural", good-for-you, etc. (see *Ice Cream's Healthy Future, Dairy Foods,* March, 2018)
    - Taken us into uncharted waters by eliminating or restricting the use of ingredients traditionally used to develop/stabilize structural properties historically associated with quality excellence.
      - Overrun, texture , creaminess/richness, shelf life.
        - (MDG, PS 80, cellulosic gums, etc.)
          - Most alternatives less functional, more vulnerable to processing variables than our old friends.
            - Challenge to QC - more vigilance required to detect quality shortcomings – need as many tools as possible.

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SENSORY EVALUATION IN QUALITY CONTROL

- Beyond hedonic perceptions.
- Requires skilled panel, trained to detect and identify departures from established standards for each product.

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SENSORY EVALUATION IN QUALITY CONTROL

- Roots in early decades of 20th century
  - —First butter standards, then others.
    - ◘Ice cream included in 1920s.
- Key factor in industry development.
  - —Importance illustrated by annual Collegiate Dairy Products Evaluation Contest.

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SENSORY EVALUATION IN QUALITY CONTROL

Description.

- Consensus has been reached on characteristics that represent departures from perfection in butter, cheddar cheese, cottage cheese, milk, yogurt and ice cream.
  - Each identified by universally accepted descriptive term.
    - Kept current by ADSA committee.
      - For QC application, ADSA list needs expansion.

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ICE CREAM DESCRIPTORS ON ADSA LIST

Additions needed

APPEARANCE

Package

Package smear
Distorted
Lacks integrity

Product

Unnatural color
Mottled
Serum separation
Short fill/overfill
Voids
Shrinkage
Expansion

Inclusion/multiflavors

Irregular distribution
Deficient
Lacks differentiation

FLAVOR

Lacks fine flavor
Low/high flavor level
Low/high sweetness
Harsh
Unnatural
Foreign
Syrup
Cooked
Lacks freshness
Old ingredient
Whey
Oxidized
Rancid
Salty
Unclean

Microbiological

- Acid

Fermented, putrid

BODY

Weak
Gummy
Crumbly/*Short*
Fluffy/Soggy

TEXTURE

Coarse
Icy
Sandy
Greasy

MELT BEHAVIOR

- *Lacks or excess shape retention*
- *Foamy*
- *Flaky/curdy*
- *Whey separation*

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VALUE OF MELTDOWN EVALUATION

- No other way to achieve consumer visual perception.

Is this what consumers are seeing?

Other values…

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VALUE OF MELTDOWN EVALUATION

- Focus on body (structure)
  - —Critical to perception of richness, creaminess.
  - —A key element of consumer quality judgment.
- Provides useful insights into broad range of other sensory properties.
  - —Simple, so why not use it?

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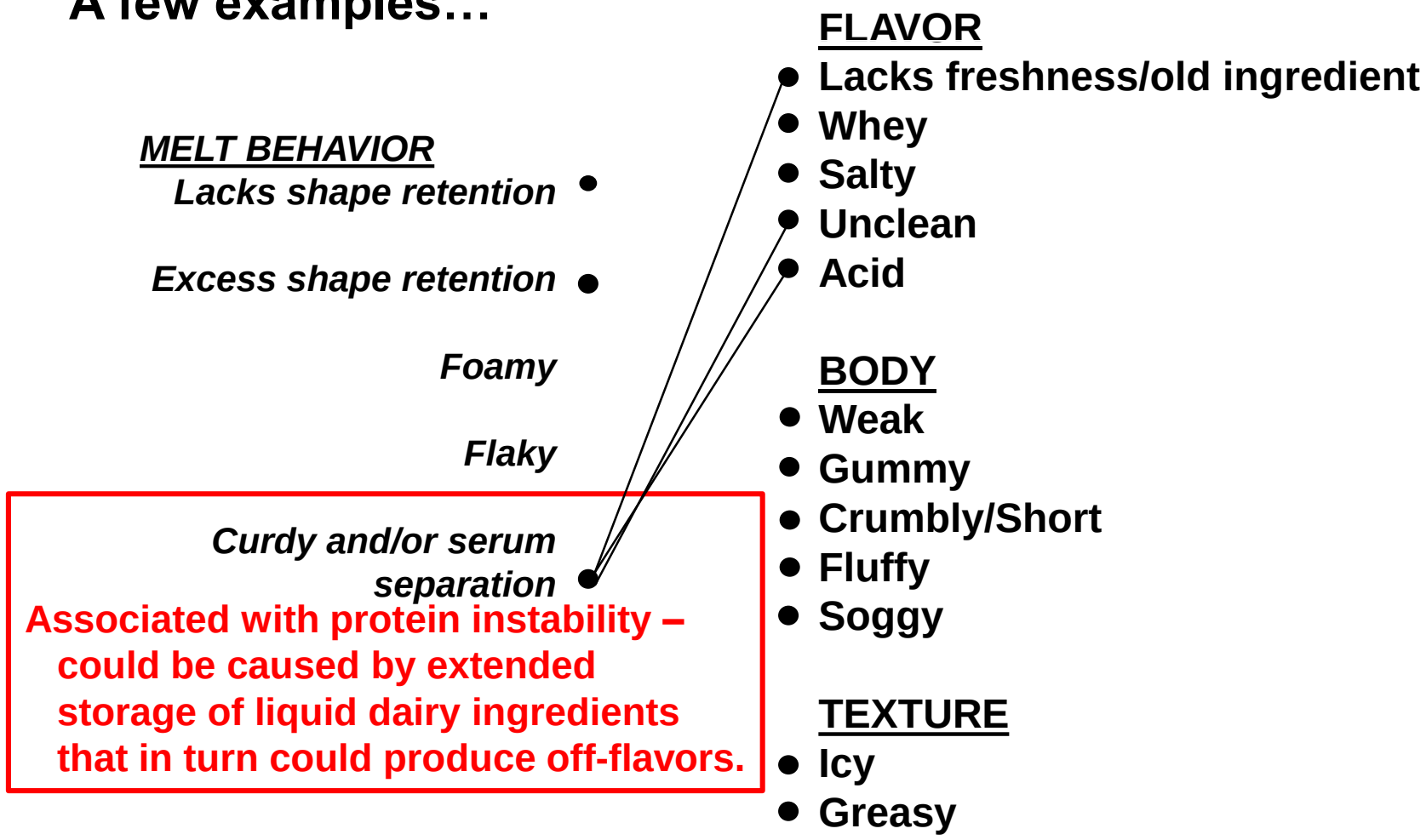
POSSIBLE RELATIONSHIPS BETWEEN MELTDOWN BEHAVIOR AND OTHER SENSORY CHARACTERISTICS: A few examples…



Associated with protein instability – could be caused by extended storage of liquid dairy ingredients that in turn could produce off-flavors.

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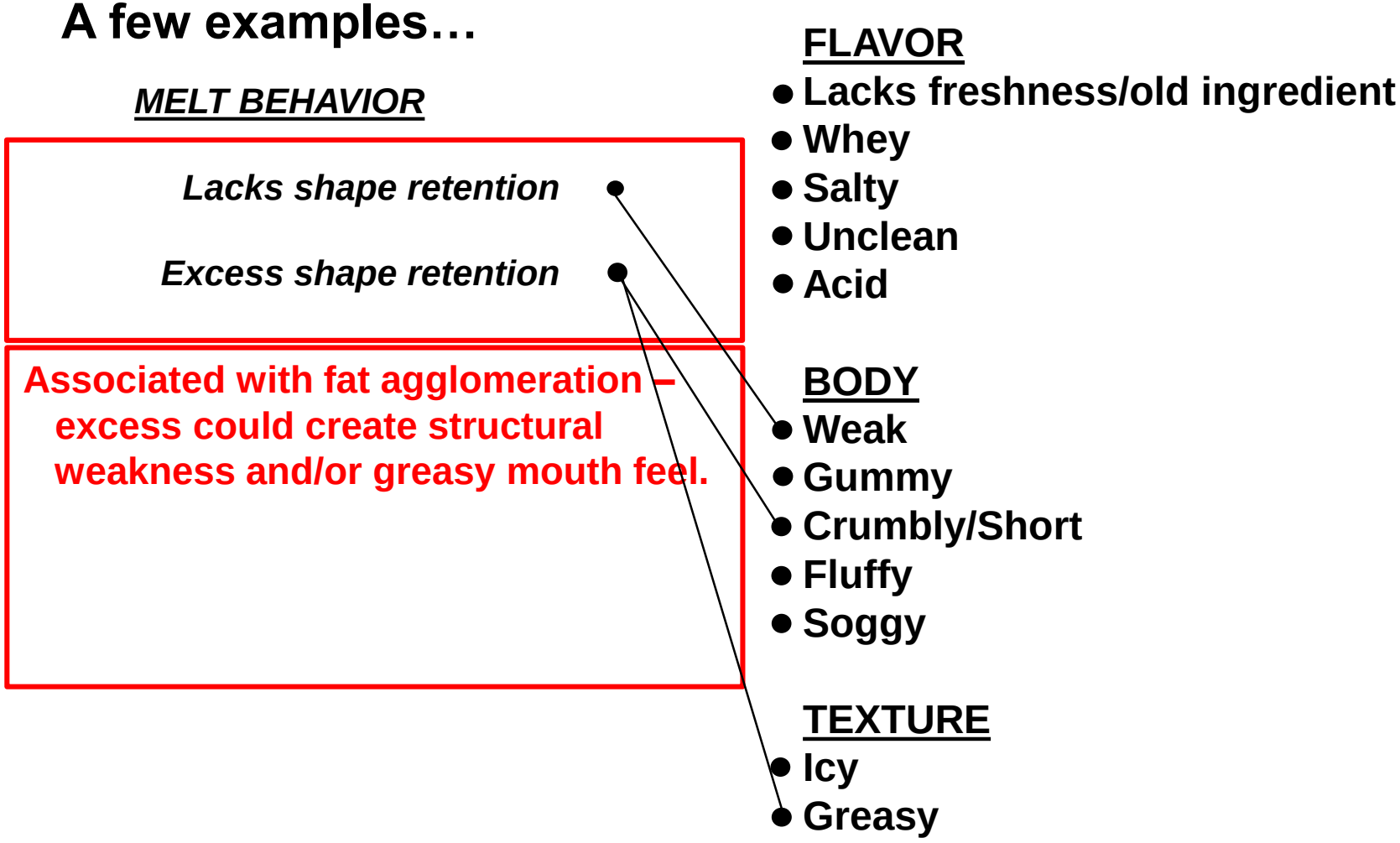
POSSIBLE RELATIONSHIPS BETWEEN MELTDOWN BEHAVIOR AND OTHER SENSORY CHARACTERISTICS: A few examples…



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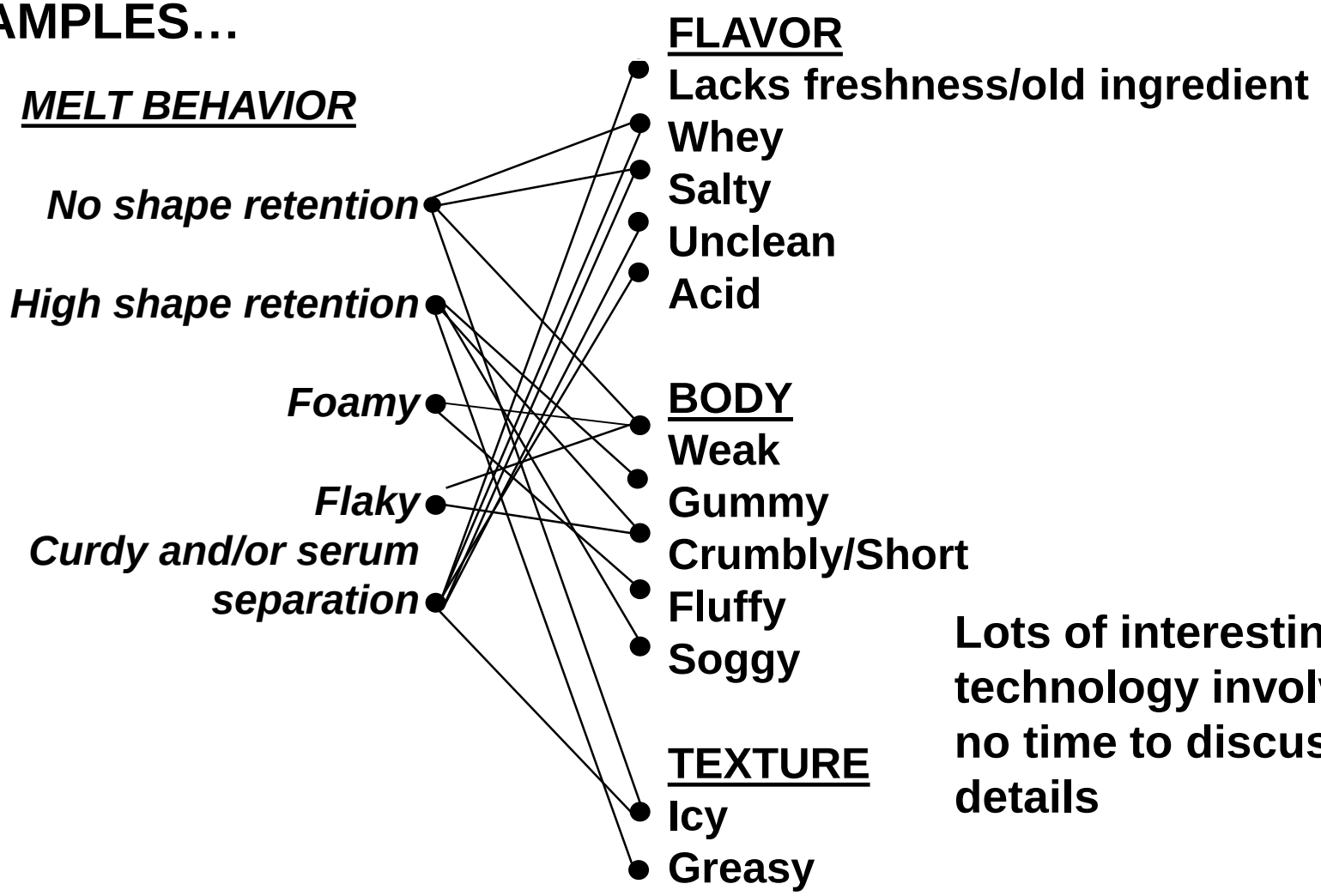
POSSIBLE RELATIONSHIPS BETWEEN MELTDOWN BEHAVIOR AND OTHER SENSORY CHARACTERISTICS: EXAMPLES…



Lots of interesting technology involved, no time to discuss details

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MELTDOWN BEHAVIOR

important index of infrastructure.

- The behavior/appearance of a portion of ice cream as it melts.
- Textbook description:
  - Melt should be smooth and homogeneous, resembling mix before freezing.
    - Possibly asking too much, considering how we want it to behave. For example:
      - Holding air desirable in frozen state. Should it be undesirable in melted product?
      - Degree of fat agglomeration that produces desirable behavior at the freezer may produce shape retention on melting.

Overview of meltdown descriptors

MELTDOWN BEHAVIOR

- Too slow/too fast.
  - More precisely, refers to shape retention during/following melting.
  - Slow loss.
    - High solids, low overrun, small air cells.
    - High degree of fat agglomeration
      - Often associated with greasy texture, short/crumbly body, even shrinkage
  - Rapid loss (often associated with weak body).
    - Low solids, low degree of water control (low viscosity in unfrozen portion), extreme degree of fat agglomeration.

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MELTDOWN DESCRIPTORS

Flaky/Curdy.

- **Flecks of material in or on the melt.**
- **Traditionally described as *curdy.***
- **Useful to use two different terms to distinguish between two possible causes.**
  - **Flaky: appears on surface.**
    - **From excess fat agglomeration.**
    - **Often associated with slow loss of shape.**

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MELTDOWN DESCRIPTORS
Flaky/curdy

- Curdy.
  - Appears in, not on, the melt.
    - Destabilized protein.
      - Dairy source with borderline protein stability can be destabilized by effects of processing, freezing and hardening.
        - High temperature.
        - Shear.
        - Freeze concentration of instabiity factors.

MELTDOWN DESCRIPTORS

- Serum (whey) separation.
  - Translucent fluid separates from the rest of the melted product.
    - Released by destabilized protein.
      - Often associated with curdiness.

- Achieving consistency in meltdown behavior is as important as for other QC parameters - fat, TS, other sensory descriptors,

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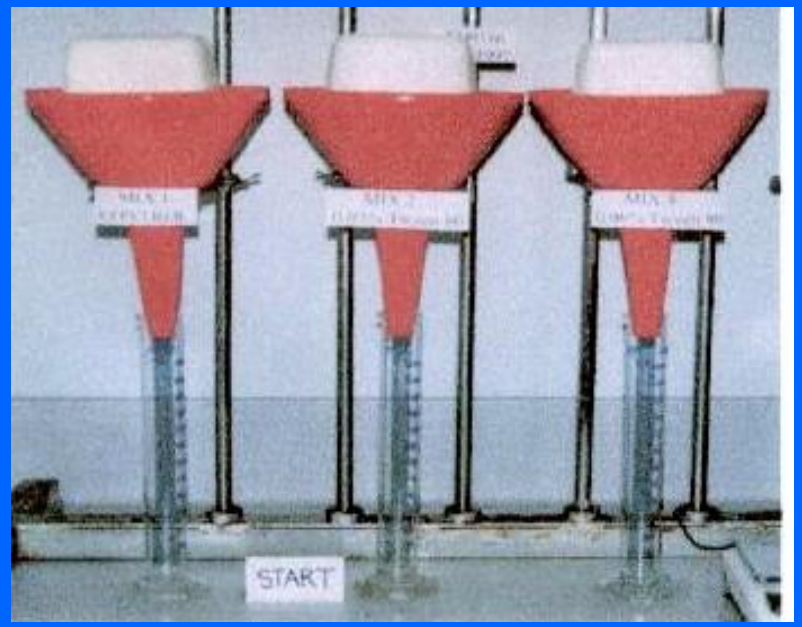
MELTDOWN OBSERVATION

- Scientific observation
  - Weighed portion placed on screen over funnel.
  - Amount of fluid collected measured at intervals.
  - Shape retention recorded via photos



Basic set-up

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MELTDOWN OBSERVATION

- Scientific observation
  - Weighed portion placed on screen over funnel.
  - Amount of fluid collected measured at intervals.
  - Shape retention recorded via photos

Scientific version

Dr. Erich J. Windhab, ETH (Federal Institute of Technology), Zurich.

Evolved into…...

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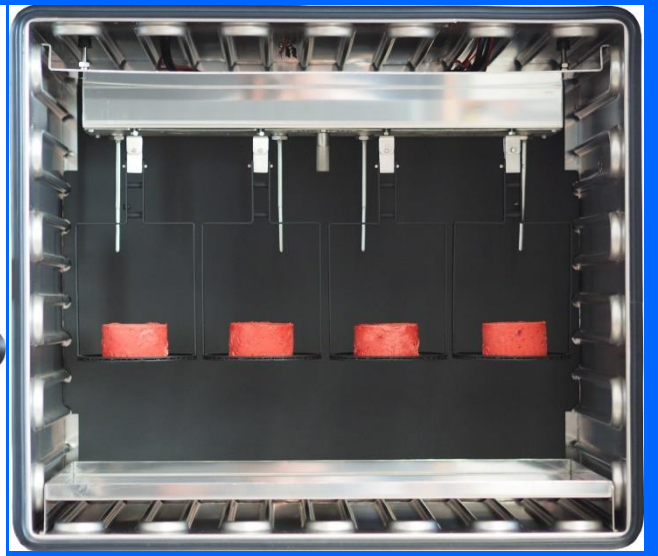
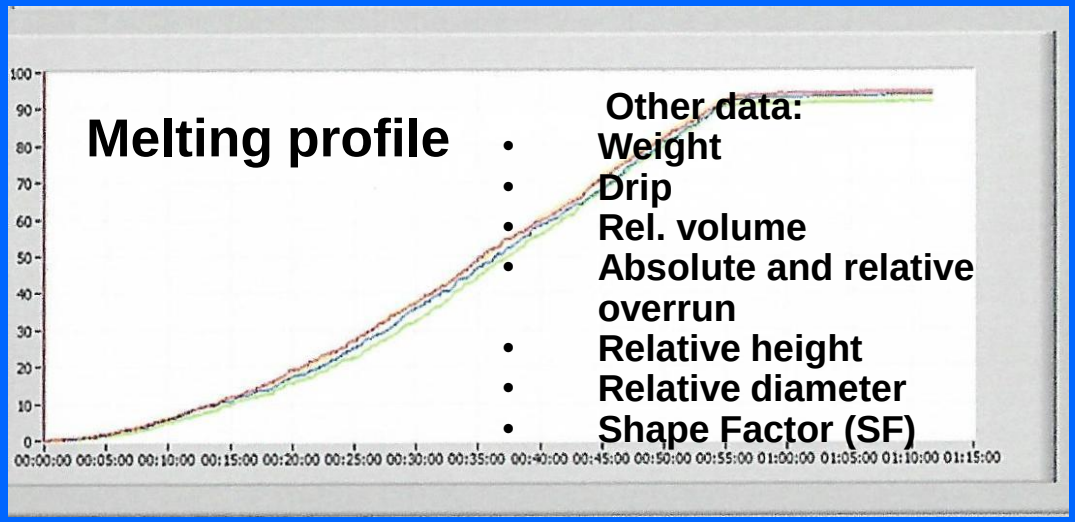
Meltdown Analyzer – available commercially





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MELTDOWN OBSERVATION AT QC LEVEL

- Sampling
  - Size uniformity
  - Avoid distortion of structure
    - Melon scoop is useful tool

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MELTDOWN SAMPLING AT QC LEVEL

- Subjective observation
  - Place small portion on dark background, observe melting behavior during other elements of sensory evaluation

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MELTDOWN BEHAVIOR

Observe at appropriate time
(~20’)

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EXAMPLES OF MELTDOWN BEHAVIOR

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MELTDOWN BEHAVIOR

Back to reality….

Initial appearance.

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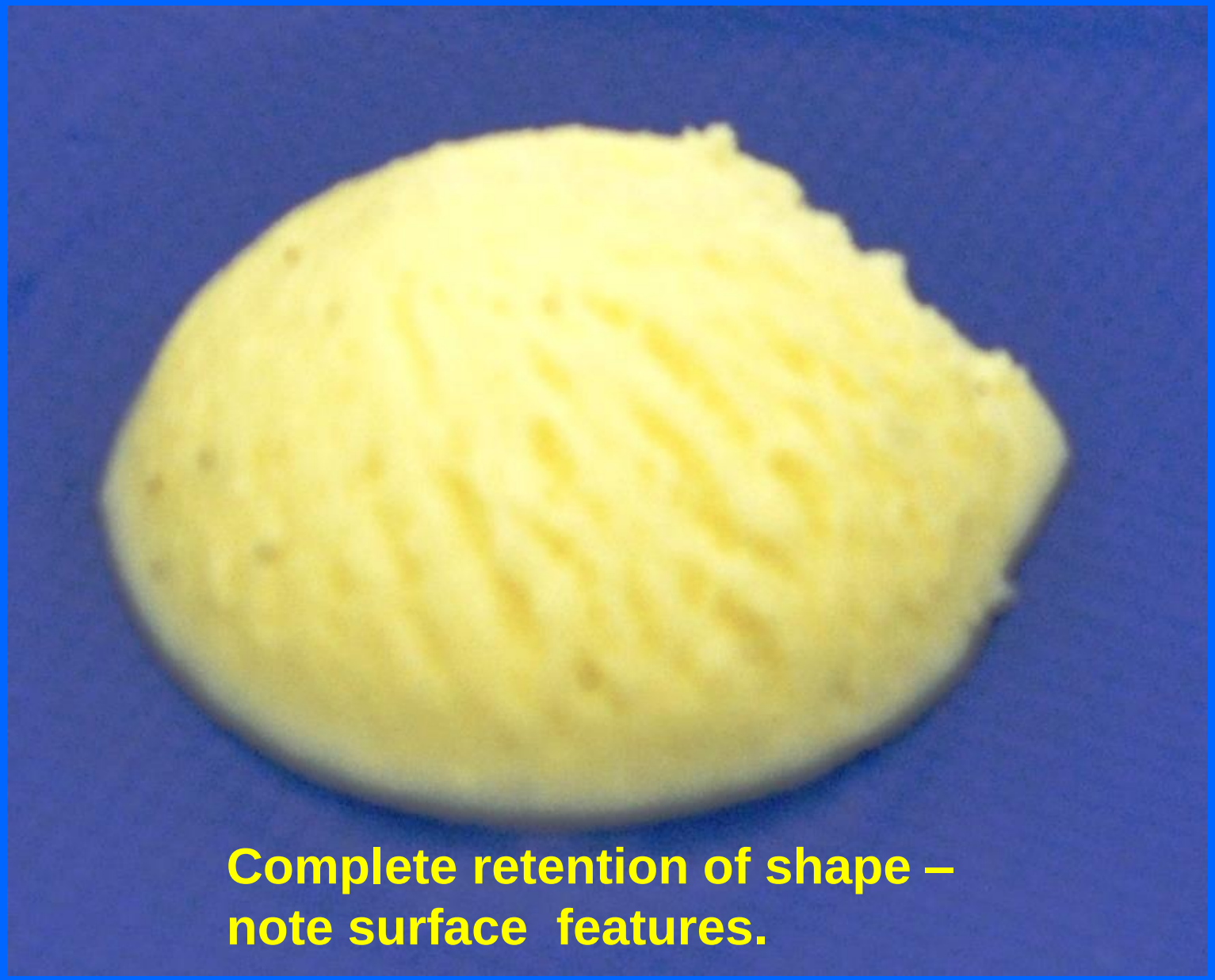

Complete retention of shape – note surface features.

Rapid loss of shape– smooth, uniform, foamy

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Which is the more acceptable?

It depends on what is typical for each product.

Both are acceptable if within the range of typical behavior.

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If this is typical…

This is unacceptable

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This is unacceptable

But, if this is typical…

Obvious defects are not acceptable.

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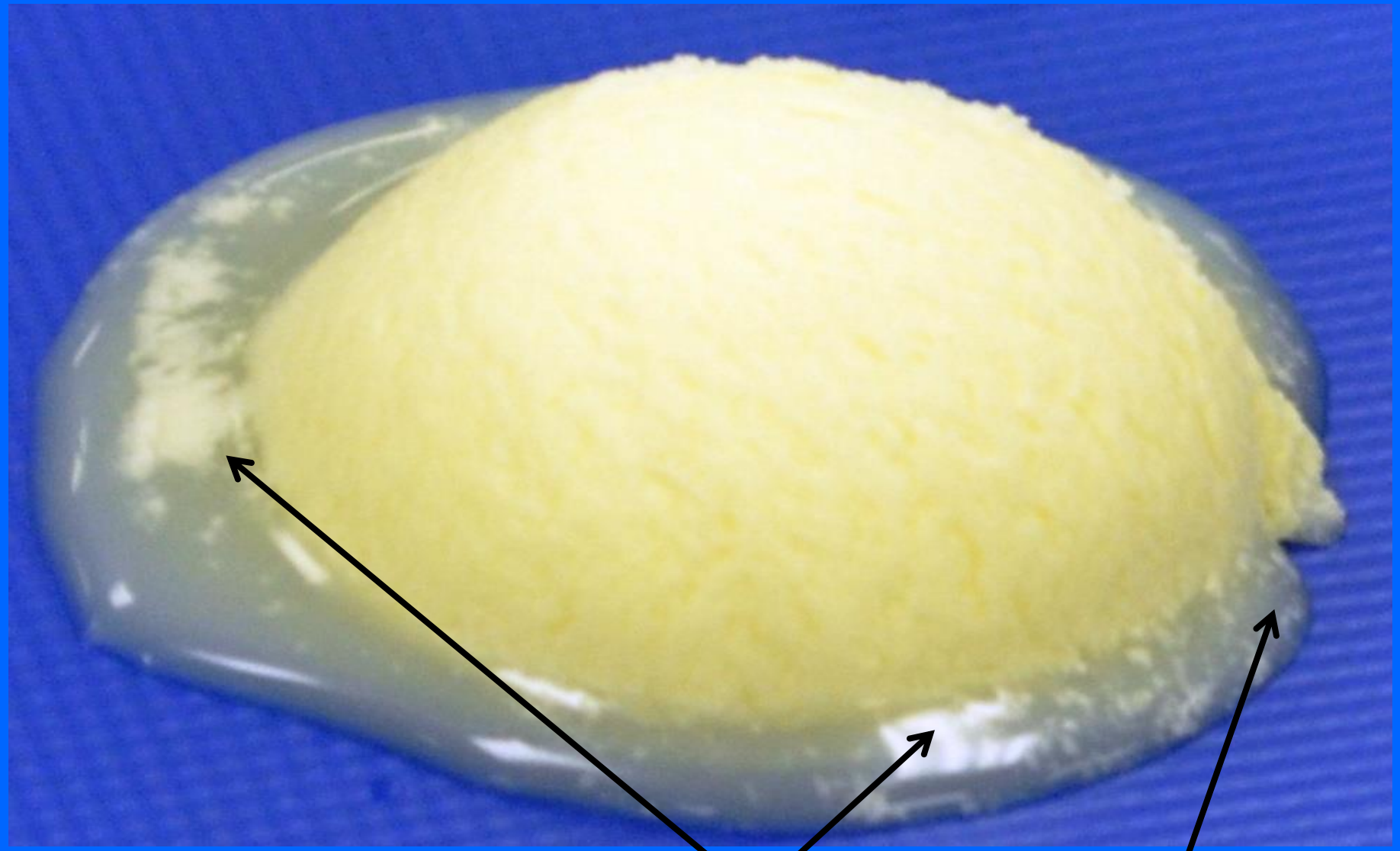

Shape retention, with flakes ,separation, curdiness

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Sl. shape retention, sl. flaky.

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Gelling , holds air bubbles.

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Shape retention, with separation, curdiness.

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Sl. shape retention, sl. flaky.

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Strong shape retention, surface features intact, sl. separation,

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Gelled , curdy , separation

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Heavier gelling, some surface feature retention and flakiness, separation/curdiness.

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Collapse, severe flaky. Separation could be from protein destabilization, or serum released by heavy fat agglomeration.

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Serum separation,
Sl. curdy

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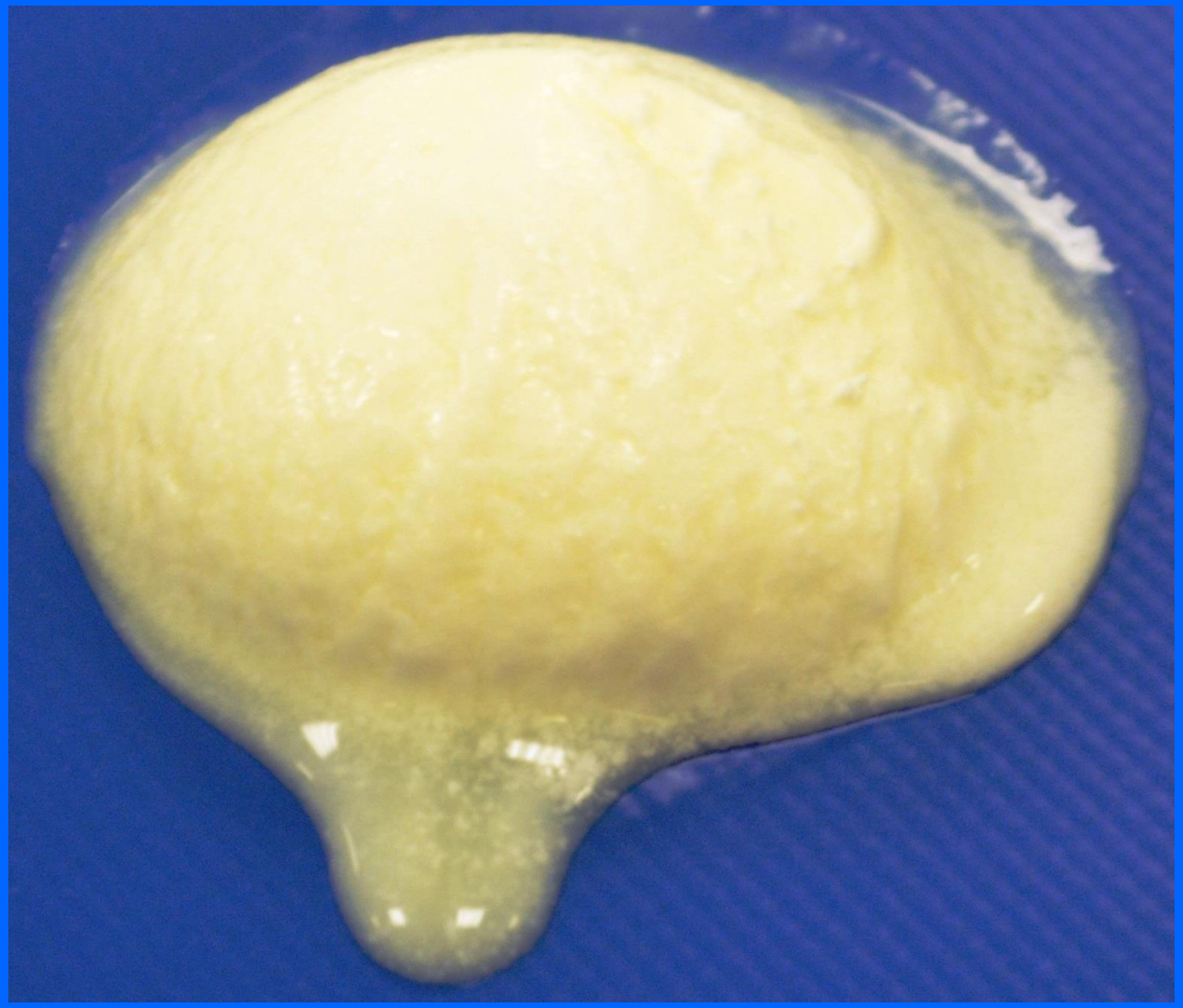

Shape retention, flaky, (very greasy); sl. separation, curdy.

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Separation, sl. curdy
Shape retention, (greasy - found lump of fat)

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V. sl. gelled, sl. foamy

Meltdown evaluation process can provide useful input into corollary elements of structure.

Now, that's gummy!

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- Meltdown evaluation can be an important part of sensory quality control.
- Now, more than ever!

- Questions?

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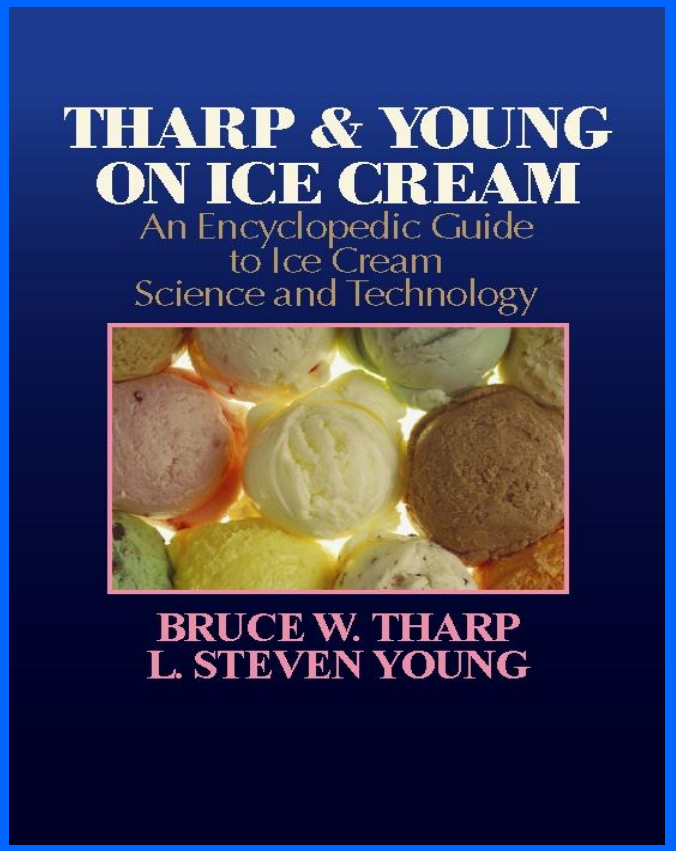
FOR MORE INFORMATION



Tharp & Young on Ice Cream:
Technical Short Course
December 5-7. 2018
Las Vegas, NV

June 17-21, 2019
National University of Singapore

For information on the book and course, visit www.onicecream.com

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MANY THANKS

- To IDFA, Cary Frye,
  - —For excellent organization of the conference.
  - —For another opportunity for me to participate.
- To all of you for your attention and courtesy over the years.

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